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Shaw Environmental & Infrastructure, Inc.

Shaw The Shaw Group Inc.™

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December 5, 2002
Project 806717

Ms. Sharon Lehn
U.S. Army Corps of Engineers
106 South 15th Street
Omaha, NE 68102-1618
CENWO-PM-HB (Lehn)

RE: Groundwater Monitoring Report for Third Quarter 2002
Duell and Gardner Landfill Site, Dalton Township, Muskegon County, Michigan

Dear Ms. Lehn:

On behalf of U.S. Environmental Protection Agency (USEPA) Region V and the U.S. Army Corp of Engineers (USACE), Shaw Environmental Inc. submits this Groundwater Monitoring Report (GMR) for annual groundwater sampling event for the third quarter of 2002. **Figure 1** is a map showing the site location. **Figure 2** is a site map that shows the location of groundwater monitoring wells. Water level measurements from site monitoring wells were gauged on September 30, 2002. Groundwater samples were collected from the corrective action monitoring wells and groundwater monitoring wells on September 30, 2002 and October 1, 2002 in accordance with the Duell & Gardner Landfill Monitoring Plan (LMP) dated March 4, 2002.

This report includes:

- Field data sheets (**Appendix A**);
- Laboratory reports with a chain of custody (**Appendix B**);
- A groundwater contour map including static water level elevations (**Figure 3**).

A copy of the laboratory data is being transmitted electronically to the MDEQ, as requested.

**Sample Identification**

Groundwater samples from these wells were collected in general accordance with the Duell & Gardner Landfill Monitoring Plan (LMP) dated March 4, 2002. Water samples were collected from the following corrective action monitoring wells and groundwater monitoring wells:

- RW-1, RW-2, RW-3
- MW-14S, MW-14I, MW-14D
- MW-17, MW-19, MW-20
- MW-21S, MW-21D
- MW-22S, MW-22D
- MW-23S, MW-23D
- MW-25S, MW-25I, MW-25D
- MW-26S, MW-26I, MW-26D

Sample identification numbers presented in the laboratory results correspond to monitoring well identification numbers. One duplicate sample was collected from monitoring well MW-25D and was labeled Dup-1. Another duplicate was collected from monitoring well MW-25S and labeled Dup-2. Matrix spike and matrix spike duplicate samples were collected from monitoring wells MW-14D and MW-25I. A field blank and a trip blank were also collected and submitted for laboratory analysis.

A water sample from the water treatment system effluent was collected for laboratory analysis on September 30, 2002 and labeled IBP.

A water sample from recovery well RW-4 was not collected during this sampling event. The pump and piping for recovery well cannot be removed manually. The granular activated carbon for recovery well RW-4 has been removed from the site and recovery well RW-4 is no longer operational. As a result, the sample technician did not collect a water sample from recovery well RW-4.

**Laboratory Analysis**

Water samples were submitted to Trace Analytical Laboratories for laboratory analysis of primary organic volatile compounds (following U.S. EPA Method 8260), secondary organic volatile compounds (following U.S. EPA Method 8270), and other compounds including 1,2-dichloroethance, n, n-dimethylaniline, n-ethylaniline, n-methylaniline, tetramethylurea, anailine, dimethylaniline, and crystal violet. The field blank and trip blank were submitted for laboratory analysis of primary volatile organic compounds.

A water sample was collected from monitoring well MW-20 and was submitted for laboratory analysis of primary volatile organic compounds. Samples from monitoring well MW-20 could not

be collected for laboratory analysis of secondary organic compounds and other parameters due to poor well recovery resulting in an insufficient volume of water.

**Flow Direction Review**

Groundwater elevations and flow patterns for the September 30, 2002 gauging event were compared to the previous flow patterns. **Table 1** presents a summary of the groundwater gauging data for the September 30, 2002. **Figure 3** shows a contour map of the static water elevations for September 30, 2002 and the general direction of groundwater flow. The September 2002 data indicates that the groundwater flow at the site is in a southeasterly direction, which is consistent with historical directions of groundwater flow for the D&G Landfill.

In March 2002, water levels between the shallow and intermediate wells were nearly identical in well cluster MW-14, which were measured before startup of the recovery well. In September 2002, water levels between these wells have a difference of 0.84 feet. To contour the water level data, we eliminated the water level from monitoring well MW-14I.

Water levels have fallen approximately three feet from March 2002 through September 2002. This is not unusual based on the dry summer experienced in Michigan. The difference in water levels may be the result of dropping water levels, it may also be the effects of the recovery operation, or a combination of both.

The cause of the water level changes in well cluster MW-14 is not clear given the existing water level data. As a result, the cone of depression does not extend to the well cluster MW-14. **Figure 3** shows contoured data with a cone of depression shown around the well cluster for MW-25.

**Water Quality Summary**

Laboratory results for the October 2002 groundwater sampling event were compared to drinking water criteria and water quality standards established by the Michigan Department of Environmental Quality (MDEQ) for Part 201 (environmental response) and Part 22 (groundwater quality) under Michigan's Natural Resources and Environmental Protection Act (NREPA), Public Act 451.

Groundwater samples from monitoring wells RW-1, MW-14I, MW-14D, MW-23S, MW-25S, MW-25I, detected acetone, carbon disulfide, chloroform, carbon tetrachloride, 1,2 dichlorobenzene, 1,4-dichlorobenzene, n,n-demethylaniline, n-methylaniline, tetramethylurea, and tetrachloroethene at concentrations ranging from 2 to 190 micrograms per liter (µg/L).

| Analyte | Well Number | Concentration (µg/L) |
|---|---|---|
| • Acetone | MW-20 | 39 |
| • Bis(2ethylhexly)phthalate | MW-25S | 6.2 |
| • Carbon Tetrachloride | RW-1 | 20 |
| | MW-25S | 190 |
| • Carbon Disulfide | MW-23S | 10 |
| • Chloroform | RW-1 | 5.3 |
| | MW-25S | 16 |
| • 1,2-Dichlorobenzene | MW-25S | 15 |
| | RW-1 | 3.2 |
| • 1,4-Dichlorobenzene | MW-25S | 2 |
| • N, N-Dimethylaniline | MW-14D | 14 |
| | MW-14I | 15 |
| • N-Methylaniline | MW-14D | 120 |
| • Tetrachloroethene | MW-25S | 2 |
| • Tetramethylurea | MW-25I | 32 |
| | RW-1 | 11 |

Laboratory results of the duplicate sample (Dup-2) from monitoring well MW-25S detected bis(2ethylhexly)phthalate at 6.2 µg/L. Bis(2ethylhexly)phthalate from monitoring well MW-25S sample was not reported above the laboratory method detection limit of 5 µg/L. Bis(2ethylhexly)phthalate (DEHP) has been used as a plastizer for poly vinyl chloride (PVC) products and packaging. DEHP is a common laboratory contaminant and may also have been introduced during sampling. At the present time, DEHP is not considered to be representative of the chemicals in the groundwater.

Laboratory results from recovery well RW-1 report crystal violet at 92 µg/L. The laboratory reports that the result is suspect due to matrix color interference. Operation and Maintenance activities have experienced fouling problems associated with the operation of recovery well RW-1. Based on the orange color described by the lab, the laboratory result for crystal violet is not considered valid for recovery well RW-1.

**Table 2** provides a historical summary for chloroform, carbon tetreachloride, n, n-dimethylaniline, n-methylaniline, 2-ethylanniline, and tetramethyl urea from groundwater sampling events at Duell & Gardner Landfill. Except for recovery well RW-1 and monitoring well MW-25S, laboratory results for the groundwater samples did not exceed the drinking water criteria and water quality standards established by MDEQ for Part 201 and Part 22, respectively. Carbon tetrachloride and exceed the drinking water criteria of 5 µg/L.

| Analyte | Well Number | Concentration (ug/L) |
|---|---|---|
| ***Part 201 Criteria*** | | |
| • Carbon Tetrachloride (5 µg/L) | RW-1 | 20 |
| | MW-25S | 190 |

During this event, chloroform and n, n-dimethylaniline do not exceed the Part 22 water quality standards. Drinking water criteria and water quality standards have not been established by the MDEQ for N-methylaniline and tetramethylurea. Detectable concentrations of N-methylaniline and tetramethylurea were detected in monitoring wells MW-14D, MW-25I, and recovery well RW-1 at concentrations ranging from 11 to 120 µg/L.

**Appendix A** contains a copy of the field data sheets for the September 30, 2002 gauging event and the October 2002 groundwater sampling event. **Appendix B** contains a hard copy of the laboratory analytical data for the October 2002 groundwater sampling event. Laboratory data for monitoring well MW-14I was incorrectly reported as monitoring well MW-14D in the original laboratory data sheets dated October 16, 2002. The laboratory results for monitoring well MW-14I were corrected and reported in separate letter dated October 22, 2002.

If you have any questions or comments regarding this report, please contact me at 734-367-1013.

Sincerely,

**SHAW ENVIRONMENTAL INC.**

Randy Sherman, CPG, CHMM
Project Manager

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Attachments Figure 1 to 3
Tables 1 and 2
Appendix A Field data sheets
Appendix B Laboratory Analytical Data

# TABLES

Shaw Project No 806717

# TABLE 1

## Groundwater Gauging Information

## September 30, 2002

Duell and Gardner Landfill

Muskegon, MI

| Well Identification | Date Measured | Top of Casing (USGS) (feet) | Ground (USGS) (feet) | Bottom of Screen (feet) | Depth to Bottom (feet) | Depth to Water (feet) | Water Elevation (feet) | Comments |
|---|---|---|---|---|---|---|---|---|
| MW-1 | 9/30/02 | 665.40 | 662.80 | 654.40 | 11.00 | 8.48 | 656.92 | |
| MW-2 | 9/30/02 | 662.10 | 660.00 | 650.60 | 11.50 | 7.71 | 654.39 | |
| MW-3 | 9/30/02 | 661.70 | 659.65 | 650.20 | 11.50 | 7.71 | 653.99 | |
| MW-4 | 9/30/02 | 663.10 | 660.90 | NA | NA | NA | NA | |
| MW-05S | 9/30/02 | 670.29 | 667.50 | 657.80 | 12.49 | NA | NA | unable to get access to |
| MW-05D | 9/30/02 | 668.51 | 667.45 | 609.35 | 59.16 | NA | NA | property from owner |
| MW-06S | 9/30/02 | 666.19 | 663.86 | NA | NA | NA | NA | |
| MW-06D | 9/30/02 | 664.99 | 663.76 | NA | NA | NA | NA | |
| MW-07 | 9/30/02 | 667.36 | 664.83 | 654.83 | 12.53 | 9.67 | 657.69 | |
| MW-08 | 9/30/02 | 667.23 | 664.60 | 654.60 | 12.63 | 9.96 | 657.27 | |
| MW-09 | 9/30/02 | 667.38 | 665.12 | 655.12 | 12.26 | Dry | Dry | |
| MW-10 | 9/30/02 | 667.00 | 663.50 | 658.80 | 8.20 | NA | NA | unable to remove cap |
| MW-11R | 9/30/02 | 666.91 | 664.24 | 666.91 | | | | Abandoned |
| MW-11I | 9/30/02 | 667.20 | 664.40 | 667.20 | | | | Abandoned |
| MW-12 | 9/30/02 | 667.14 | 664.94 | 654.94 | 12.20 | Dry | Dry | |
| MW-13 | 9/30/02 | 676.20 | 673.70 | 676.20 | | | | Abandoned |
| MW-14S | 9/30/02 | 670.21 | 668.01 | 654.51 | 15.70 | 13.85 | 656.36 | |
| MW-14I | 9/30/02 | 669.45 | 667.27 | 624.77 | 44.68 | 12.25 | 657.20 | |
| MW-14D | 9/30/02 | 670.95 | 667.76 | 602.76 | 68.19 | 10.90 | 660.05 | |
| MW-14E | 9/30/02 | 670.71 | 668.18 | 573.18 | 97.53 | 11.79 | 658.92 | |
| MW-15 | 9/30/02 | 666.01 | 664.70 | 666.01 | | | | Abandoned |
| MW-16 | 9/30/02 | 663.89 | 662.06 | 663.89 | | | | Abandoned |
| MW-17 | 9/30/02 | 662.84 | 660.66 | 652.16 | 10.68 | Dry | Dry | |
| MW-18 | 9/30/02 | 663.54 | 661.31 | 663.54 | | | | Abandoned |
| MW-18I | 9/30/02 | 662.25 | 661.30 | 662.25 | | | | Abandoned |
| MW-19 | 9/30/02 | 663.42 | 660.95 | 650.95 | 12.47 | 9.32 | 654.10 | |
| MW-20 | 9/30/02 | 662.06 | 660.18 | 651.68 | 10.38 | 8.18 | 653.88 | |
| MW-21S | 9/30/02 | 662.69 | 660.78 | 650.78 | 11.91 | 7.62 | 655.07 | |
| MW-21D | 9/30/02 | 663.25 | 660.91 | 590.91 | 72.34 | 8.14 | 655.11 | |
| MW-22S | 9/30/02 | 662.13 | 659.83 | 649.83 | 12.30 | 8.61 | 653.52 | |
| MW-22D | 9/30/02 | 661.78 | 659.98 | 611.58 | 50.20 | 8.31 | 653.47 | |
| MW-23S | 9/30/02 | 661.43 | 658.75 | 648.75 | 12.68 | 8.20 | 653.23 | |
| MW-23D | 9/30/02 | 661.61 | 658.74 | 609.24 | 52.37 | 8.40 | 653.21 | |
| MW-25S | 9/30/02 | 668.10 | 666.20 | 651.70 | 16.40 | 12.09 | 656.01 | |
| MW-25I | 9/30/02 | 668.21 | 665.07 | 620.07 | 48.14 | 12.25 | 655.96 | |
| MW-25D | 9/30/02 | 667.46 | 665.86 | 602.36 | 65.10 | 10.90 | 656.56 | |
| MW-26S | 9/30/02 | 662.68 | 661.36 | 647.76 | 14.92 | 7.59 | 655.09 | |
| MW-26I | 9/30/02 | 662.74 | 661.21 | 617.61 | 45.13 | 7.54 | 655.20 | |
| MW-26D | 9/30/02 | 663.35 | 661.29 | 593.29 | 70.06 | 7.45 | 655.90 | |
| MW-31 | 9/30/02 | 661.61 | 659.61 | 651.61 | 10.00 | 7.96 | 653.65 | |
| MW-32 | 9/30/02 | 662.13 | 660.25 | 651.25 | 10.88 | 8.10 | 654.03 | |
| MW-33 | 9/30/02 | 664.01 | 661.55 | 651.55 | 12.46 | 8.74 | 655.27 | |
| MW-34 | 9/30/02 | NA | 0.00 | NA | NA | 9.13 | NA | |
| MW-35 | 9/30/02 | NA | 0.00 | NA | NA | 8.60 | NA | |
| MWPZ-1 | 9/30/02 | NA | 0.00 | NA | NA | NA | NA | |
| MW-11D | 9/30/02 | NA | 0.00 | NA | NA | NA | NA | |
| IB | 9/30/02 | NA | 0.00 | NA | NA | NA | NA | |
| RW-1 | 9/30/02 | NA | NA | NA | NA | NA | NA | |
| RW-2 | 9/30/02 | NA | 0.00 | NA | NA | 9.50 | NA | not locked |
| RW-3 | 9/30/02 | NA | 0.00 | NA | NA | 8.85 | NA | not locked |
| RW-4 | 9/30/02 | NA | NA | NA | NA | NA | NA | |
| | | | | | | | | |

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# TABLE 2

## Site Water Quality Data
## Duell and Gardner Landfill
## Muskegon, MI

| | | Chloroform | Carbon Tetrachloride | Trichloroethene | Toluene | Aniline | N,N-Dimethylaniline | N-Methylaniline | 2-Ethylaniline | Tetramethyl Urea | Phenol | Butanimide | 3-Methyl-Benzenamine | P-Toluidine | N-Ethylaniline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PART 201 CRITERIA** | | 100 | 5 | 5 | 790 | 53 | 16 | NA | NA | NA | NA | NA | NA | 15 | NA |
| **PART 22 STANDARD** | | 20 | 5 | 5 | 35 | 60 | 16 | NA | NA | NA | 35 | NA | NA | 4.5 | NA |
| **WELL ID** | **DATE** | | | | | | | | | | | | | | |
| RW-1 (TW-1) | 7/1/00 | 4.5 | 11 | ND | ND | ND | ND | ND | ND | 59 | ND | ND | ND | ND | NA |
| | 10/1/00 | 11 | 22 | ND | ND | ND | ND | ND | ND | 110 | ND | ND | ND | ND | NA |
| | 12/1/00 | 3.4 | 20 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 4/1/01 | 66 | 130 | ND | ND | ND | ND | ND | ND | 260 | ND | ND | ND | ND | NA |
| | 6/27/01 | 8.9 | 22 | ND | ND | 36 | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 6/28/01 | 8.6 | 18 | ND | ND | ND | ND | ND | NA | 48 | ND | NA | NA | ND | ND |
| | 6/29/01 | 6.8 | 14 | ND | ND | ND | ND | ND | NA | 50 | ND | NA | NA | ND | ND |
| | 6/30/01 | 4.4 | 8.9 | ND | ND | ND | ND | ND | NA | 59 | ND | NA | NA | ND | ND |
| | 7/1/01 | 3.9 | 8.3 | ND | ND | ND | ND | ND | NA | 42 | ND | NA | NA | ND | ND |
| | 7/2/01 | 4.0 | 7.5 | ND | ND | ND | ND | ND | NA | 43 | ND | NA | NA | ND | ND |
| | 7/3/01 | 3.7 | 8 | ND | ND | ND | ND | ND | NA | 40 | ND | NA | NA | ND | ND |
| | 7/10/01 | 3.8 | 18 | ND | ND | ND | ND | ND | NA | 34 | ND | NA | NA | NA | ND |
| | 7/20/01 | 3.2 | 34 | ND | ND | ND | ND | ND | NA | 17 | ND | NA | NA | NA | ND |
| | 7/25/01 | 3.8 | 21 | ND | ND | ND | ND | ND | NA | 15 | ND | NA | NA | NA | ND |
| | 8/6/01 | 4.4 | 13 | ND | ND | ND | ND | ND | NA | 11 | ND | NA | NA | NA | ND |
| | 8/14/01 | 4.2 | 12 | ND | ND | ND | ND | ND | NA | 13 | ND | NA | NA | NA | ND |
| | 8/20/01 | 5.4 | 6.5 | ND | ND | ND | ND | ND | NA | 15 | ND | NA | NA | NA | ND |
| | 8/27/01 | 8.9 | 8.1 | ND | ND | ND | ND | ND | NA | 48 | ND | NA | NA | NA | ND |
| | 9/6/01 | 3.3 | 8.3 | ND | ND | ND | ND | ND | NA | 15 | ND | NA | NA | NA | ND |
| | 9/13/01 | 4.8 | 12 | ND | ND | ND | ND | ND | NA | 16 | ND | NA | NA | NA | ND |
| | 9/17/01 | 3.2 | 10 | ND | ND | ND | ND | ND | ND | 9 | ND | NA | NA | NA | ND |
| | 9/25/01 | 2.8 | 12 | ND | ND | ND | ND | ND | ND | 6.4 | ND | NA | NA | NA | ND |
| | 10/18/01 | 2.6 | 11 | ND | ND | ND | ND | ND | ND | 6.8 | ND | NA | NA | NA | ND |
| | 11/5/01 | 3.1 | 9.3 | ND | ND | ND | ND | ND | ND | 12 | ND | NA | NA | NA | ND |
| | 12/7/01 | ND | 8.6 | ND | ND | ND | ND | ND | ND | 9.4 | ND | NA | NA | NA | ND |
| | 4/4/02 | 22 | 25 | ND | ND | ND | ND | ND | NA | 17 | ND | NA | NA | NA | ND |
| | 5/30/02 | 8.4 | 18 | ND | ND | ND | ND | ND | NA | 13 | ND | NA | NA | NA | ND |
| | 6/26/02 | 8.1 | 21 | ND | ND | ND | ND | ND | NA | 18 | ND | NA | NA | NA | ND |
| | 7/24/02 | 5.8 | 40 | ND | ND | ND | ND | ND | NA | 6.5 | ND | NA | NA | NA | ND |
| | 9/30/02 | 5.3 | 20 | ND | ND | ND | ND | ND | ND | 11 | ND | NA | NA | NA | ND |
| RW-2 (near MW-13) | 5/1/01 | 1.2 | 0.7 | 1.8 | 16 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 6/14/01 | ND | ND | ND | ND | ND | ND | ND | NA | 8.5 | ND | NA | NA | NA | NA |
| | 10/18/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 4/4/02 | ND | ND | ND | ND | ND | ND | ND | NA | 17 | ND | NA | NA | NA | NA |
| | 10/1/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| RW-3 (near GP-4/9) | 5/1/01 | ND | ND | ND | ND | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 6/14/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | NA |
| | 10/18/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 4/4/02 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | NA |
| | 10/1/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| RW-4 (near MW-14) | 5/1/01 | ND | ND | ND | ND | ND | 30 | 26 | ND | ND | ND | ND | ND | ND | NA |
| | 6/27/01 | ND | ND | ND | ND | ND | 25 | 30 | NA | ND | ND | NA | NA | ND | ND |
| | 6/28/01 | ND | ND | ND | ND | ND | 17 | 24 | NA | ND | ND | NA | NA | ND | ND |
| | 6/29/01 | ND | ND | ND | ND | ND | ND | ND | NA | 28 | ND | NA | NA | ND | 17 |
| | 6/30/01 | ND | ND | ND | ND | ND | 17 | 24 | NA | ND | ND | NA | NA | ND | ND |
| | 7/1/01 | ND | ND | ND | ND | ND | 16 | 27 | NA | ND | ND | NA | NA | ND | ND |
| | 7/2/01 | ND | ND | ND | ND | ND | 18 | 26 | NA | ND | ND | NA | NA | ND | ND |
| | 7/3/01 | ND | ND | ND | ND | ND | 16 | 24 | NA | ND | ND | NA | NA | ND | ND |
| | 7/10/01 | ND | ND | ND | ND | ND | 10 | 18 | NA | ND | ND | NA | NA | ND | ND |
| | 7/20/01 | ND | ND | ND | ND | ND | 8.3 | 15 | NA | ND | ND | NA | NA | ND | ND |
| | 7/25/01 | ND | ND | ND | ND | ND | 12 | 21 | NA | ND | ND | NA | NA | ND | ND |
| | 8/6/01 | ND | ND | ND | ND | ND | ND | 14 | NA | ND | ND | NA | NA | ND | ND |
| | 8/14/01 | ND | ND | ND | ND | ND | 8.7 | 15 | NA | ND | ND | NA | NA | ND | ND |
| | 8/20/01 | ND | ND | ND | ND | ND | 7.8 | 16 | NA | ND | ND | NA | NA | ND | ND |
| | 8/27/01 | ND | ND | ND | ND | ND | 8.4 | 14 | NA | ND | ND | NA | NA | ND | ND |
| | 9/6/01 | ND | ND | ND | ND | ND | 8.5 | 14 | NA | ND | ND | NA | NA | ND | ND |
| | 9/13/01 | ND | ND | ND | ND | ND | 6.6 | 9.4 | NA | ND | ND | NA | NA | ND | ND |
| | 9/17/01 | ND | ND | ND | ND | ND | 6.7 | 12 | NA | ND | ND | NA | NA | ND | ND |
| | 9/25/01 | ND | ND | ND | ND | ND | 5.6 | 11 | NA | ND | ND | NA | NA | ND | ND |
| | 10/18/01 | ND | ND | ND | ND | ND | ND | 13 | NA | ND | ND | NA | NA | ND | ND |
| | 11/5/01 | ND | ND | ND | ND | ND | ND | 10 | NA | ND | ND | NA | NA | ND | ND |
| | 12/7/01 | ND | ND | ND | ND | ND | ND | 8.0 | NA | ND | ND | NA | NA | ND | ND |
| | 4/4/02 | ND | ND | ND | ND | ND | 11 | 22 | NA | ND | ND | NA | NA | ND | ND |
| MW-7 | 6/27/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |

# TABLE 2

**Site Water Quality Data**

**Duell and Gardner Landfill**

**Muskegon, MI**

| | | Chloroform | Carbon Tetrachloride | Trichloroethene | Toluene | Aniline | N,N-Dimethylaniline | N-Methylaniline | 2-Ethylaniline | Tetramethyl Urea | Phenol | Butaniimide | 3-Methyl-Benzenamine | P-Toluidine | N-Ethylaniline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PART 201 CRITERIA** | | **100** | **5** | **5** | **790** | **53** | **16** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **15** | **NA** |
| **PART 22 STANDARD** | | **20** | **5** | **5** | **35** | **60** | **16** | **NA** | **NA** | **NA** | **35** | **NA** | **NA** | **4.5** | **NA** |
| **WELL ID** | **DATE** | | | | | | | | | | | | | | |
| MW-14S | 7/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 10/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 12/1/00 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NA |
| | 4/1/01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 6/14/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | NA |
| | 10/17/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 4/4/02 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | NA |
| | 10/1/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-14I | 7/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 7.7 | NA |
| | 10/1/00 | ND | ND | ND | ND | ND | 24 | 3 | ND | ND | ND | ND | 7 | ND | NA |
| | 12/1/00 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NA |
| | 4/1/01 | ND | ND | ND | ND | ND | 24 | ND | ND | ND | ND | ND | ND | ND | NA |
| | 6/14/01 | ND | ND | ND | ND | ND | 11 | 7.3 | NA | ND | ND | NA | NA | ND | NA |
| | 10/17/01 | ND | ND | ND | ND | ND | 13 | ND | NA | ND | ND | NA | NA | NA | ND |
| | 4/4/02 | ND | ND | ND | ND | ND | 14 | ND | NA | ND | ND | NA | NA | ND | NA |
| | 10/1/02 | ND | ND | ND | ND | ND | 15 | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-14D | 7/1/00 | ND | ND | ND | ND | ND | ND | 78 | ND | ND | ND | ND | ND | ND | NA |
| | 10/1/00 | ND | ND | ND | ND | ND | 29 | 87 | 5 | ND | ND | ND | ND | ND | NA |
| | 12/1/00 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NA |
| | 4/1/01 | ND | ND | ND | ND | ND | 22 | ND | ND | ND | ND | ND | ND | ND | NA |
| | 6/14/01 | ND | ND | ND | ND | ND | 14 | 73 | NA | ND | ND | NA | NA | NA | NA |
| | 10/17/01 | ND | ND | ND | ND | ND | 19 | 120 | NA | ND | ND | NA | NA | NA | 5.2 |
| | 4/4/02 | ND | ND | ND | ND | ND | 15 | 60 | NA | ND | ND | NA | NA | NA | NA |
| | 10/1/02 | ND | ND | ND | ND | ND | 14 | 120 | ND | ND | ND | NA | NA | NA | ND |
| MW-14E | 7/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 10/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 12/1/00 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NA |
| | 4/1/01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 10/17/01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| MW-19 | 9/30/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-20 | 9/30/02 | ND | ND | ND | ND | NA | NA | NA | NA | NA | NA | NA | NA | NA | ND |
| MW-21S | 10/18/01 | ND | ND | ND | ND | ND | ND | NA | NA | NA | NA | NA | NA | NA | NA |
| | 10/1/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-21D | 10/18/01 | ND | ND | ND | ND | ND | ND | NA | NA | NA | NA | NA | NA | NA | NA |
| | 10/1/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-22D | 9/30/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-22S | 9/30/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-23D | 9/30/02 | ND | ND | ND | ND | ND | ND | ND | ND | 6.1 | ND | NA | NA | NA | ND |
| MW-23S | 9/30/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-25S | 7/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | 23 | ND | ND | ND | ND | NA |
| | 10/1/00 | 46 | 110 | ND | ND | ND | ND | ND | ND | 8 | 5 | ND | ND | ND | NA |
| | 12/1/00 | 14 | 74 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 4/1/01 | 45 | 76 | ND | ND | ND | ND | ND | ND | 140 | ND | ND | ND | ND | NA |
| | 6/14/01 | ND | 9.1 | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | NA |
| | 10/16/01 | 11 | 110 | ND | ND | ND | ND | ND | ND | 44 | ND | NA | NA | ND | ND |
| | 4/3/02 | 6.5 | 35 | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | NA |
| | 10/1/02 | 16 | 190 | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-25I | 7/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 10/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 12/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 4/1/01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 6/14/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | NA |
| | 10/16/01 | ND | ND | ND | ND | ND | ND | ND | NA | 8.4 | ND | NA | NA | ND | ND |
| | 4/4/02 | ND | ND | ND | ND | ND | ND | ND | NA | 28 | ND | NA | NA | ND | NA |
| | 10/1/02 | ND | ND | ND | ND | ND | ND | ND | ND | 32 | ND | NA | NA | NA | ND |
| MW-25D | 7/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 10/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | 14 | ND | ND | NA |
| | 12/1/00 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 4/1/01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA |
| | 6/14/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | NA |
| | 10/16/01 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| | 4/4/02 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | NA |
| | 10/1/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |

# TABLE 2

## Site Water Quality Data

## Duell and Gardner Landfill

## Muskegon, MI

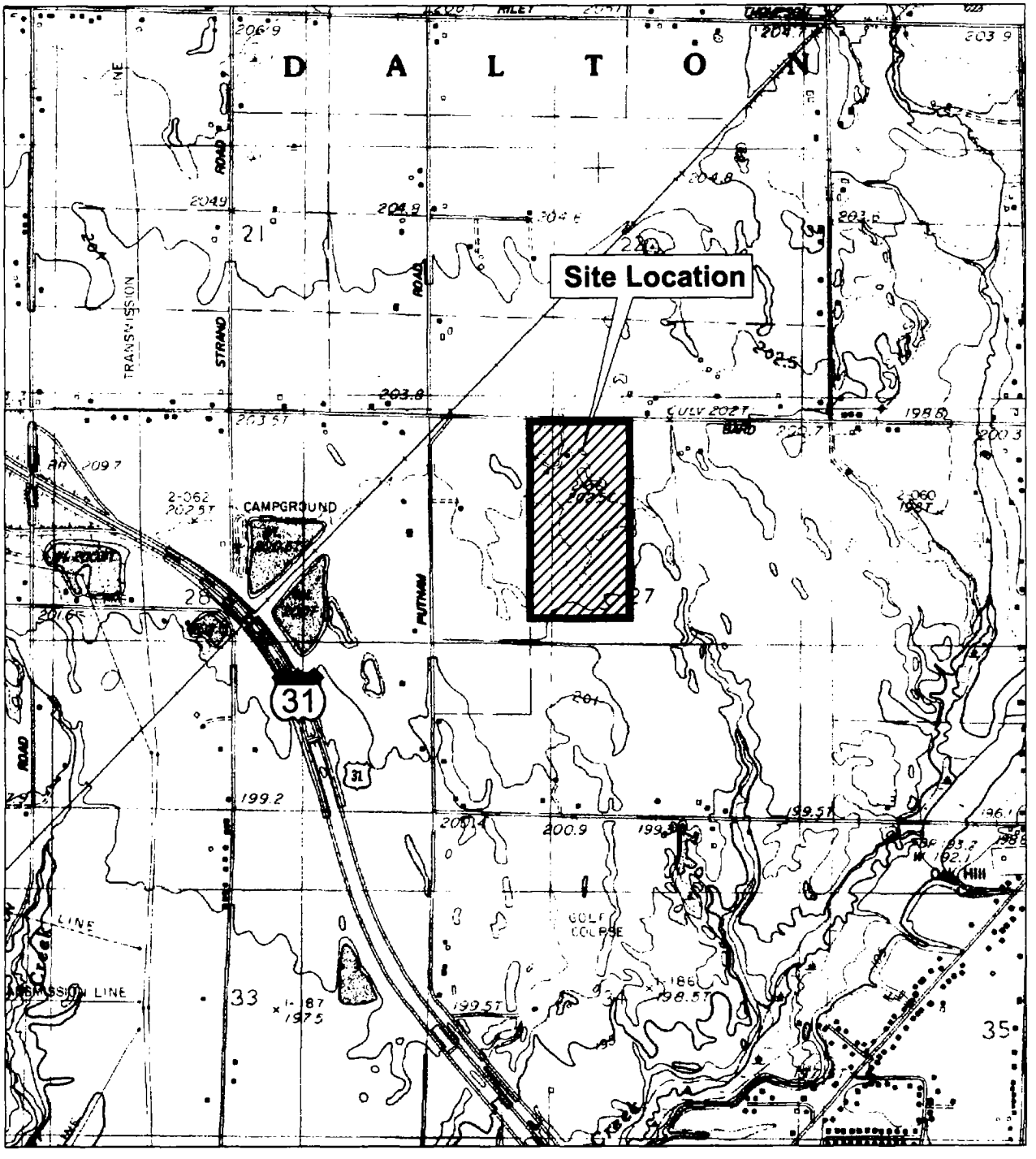
| | | Chloroform | Carbon Tetrachloride | Trichloroethene | Toluene | Aniline | N,N-Dimethylaniline | N-Methylaniline | 2-Ethylaniline | Tetramethyl Urea | Phenol | Butanimide | 3-Methyl-Benzenamine | P-Toluidine | N-Ethylaniline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PART 201 CRITERIA** | | **100** | **5** | **5** | **790** | **53** | **16** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **15** | **NA** |
| **PART 22 STANDARD** | | **20** | **5** | **5** | **35** | **60** | **16** | **NA** | **NA** | **NA** | **35** | **NA** | **NA** | **4.5** | **NA** |
| **WELL ID** | **DATE** | | | | | | | | | | | | | | |
| MW-26S | 10/17/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 9/30/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-26I | 10/17/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 9/30/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-26D | 10/17/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 9/30/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-31 | 9/30/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-32 | 9/30/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-33 | 10/1/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |
| MW-34 (near MW-16) | 5/1/01 | ND | ND | ND | ND | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 10/18/01 | ND | ND | ND | ND | ND | ND | NA | NA | NA | NA | NA | NA | NA | NA |
| | 4/3/02 | ND | ND | ND | ND | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| MW-35 (near MW-18) | 5/1/01 | ND | ND | ND | ND | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 10/18/01 | ND | ND | ND | ND | ND | ND | NA | NA | NA | NA | NA | NA | NA | NA |
| | 4/3/02 | ND | ND | ND | ND | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| IBP | 6/27/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 6/28/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 6/29/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 6/30/01 | **4.5** | **9.1*** | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 7/1/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 7/2/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 7/3/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | ND | ND |
| | 7/10/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 7/20/01 | ND | **1** | ND | ND | ND | ND | ND | NA | **4.3** | ND | NA | NA | NA | ND |
| | 7/25/01 | ND | **1.2** | ND | ND | ND | ND | ND | NA | **6.2** | ND | NA | NA | NA | ND |
| | 8/6/01 | ND | **1.5** | ND | ND | ND | ND | ND | **14** | **5.3** | ND | NA | NA | NA | ND |
| | 8/14/01 | ND | **2** | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 8/20/01 | **1.5** | **1.1** | ND | ND | ND | ND | ND | NA | **9** | ND | NA | NA | NA | ND |
| | 8/27/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 9/6/01 | **1.9** | **3.5** | ND | ND | ND | ND | ND | NA | **6.8** | ND | NA | NA | NA | ND |
| | 9/17/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 9/25/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 10/18/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 11/5/01 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 12/7/01 | ND | **1.3** | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 5/30/02 | ND | **1.1** | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 6/26/02 | ND | ND | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 7/24/02 | **1.3** | **7.5** | ND | ND | ND | ND | ND | NA | ND | ND | NA | NA | NA | ND |
| | 9/30/02 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | NA | NA | NA | ND |

Note:
All values in micrograms/liter
ND = Not Detected
NS = Not Sampled
NA = Not Available

* = Data for IBP for 6/30/01 shows a detection of chloroform and carbon tetrachloride. Since these compounds were not detected in any of the other sampling events it is likely to assume that these concentrations were result of a mislabeled bottle with RW-1 samples on the same day. The concentrations detected mimic those of RW-1.

N:\Commercial\projects\USACE\DuellGardner\Montonng 2002\DG Groundwater data.xls

# FIGURES




APPROXIMATE SCALE IN FEET

0 1000 2000 3000

*Taken from the*

TWIN LAKE, MICH.

*7.5 Series U.S.G.S. Topographic Quadrangle*

PROVISIONAL EDITION

1985

43086-C2-TM-024


Shaw™

Shaw Environmental, Inc.

| | |
|---|---|
| DATE | 05/14/03 |
| DWN | DGS |
| APP | JMA |
| REV | NAM |
| PROJECT NO. | 806717 |

**FIGURE 1**

DUELL & GARDNER LANDFILL

DALTON TOWNSHIP, MUSKEGON, MICHIGAN

**SITE LOCATION MAP**

1" 1/2" 0" 1"

XRef Files: IMAGE Files: DG-USGS.jpg

File: N:\CADDATA\DWG\Duell-Gardner\806717\VDGUSGS1.dwg Layout: 2002-04-01 User: nancy.mcpherson May 15, 2003 - 4:20pm

N

MW-33
MW-32
MW-22D
MW-22S
MW-23S
MW-23D
MW-6D
MW-6S
MW-10
RW-3
MW-25D
MW-25I
MW-25S
MW-PZ1
RW-1
CONTROL BUILDING
MW-26D
MW-26S
MW-26 I
MW-19
MW-20
RW-2
MW-12
MW-14 I
MW-14E
MW-9
RW-4
MW-14S
MW-14D
MW-3
MW-35
MW-21S
MW-21D
MW-34
MW-8
MW-17
MW-2
BARD ROAD
MW-5D
MW-5S
MW-7
MW-1
APPROXIMATE LIMITS OF FORMER LANDFILL
MW-4
INFILTRATION BASIN

MAP MODIFIED FROM EARTH TECH PDI REPORT, NOV 1996 AND ADRIAN BROWN "PROPOSED PUMPING SCHEMATIC", MAY 2001.

APPROXIMATE SCALE IN FEET
0 100 200 300

LEGEND

- PHASE I SOIL BORING/MONITORING POINT
- PHASE II SOIL BORING/MONITORING POINT
- SOIL BORING/MONITORING POINT (INSTALLED 1996)
- SITE BOUNDARY LOCATION
- UNPAVED ROAD
- FENCE

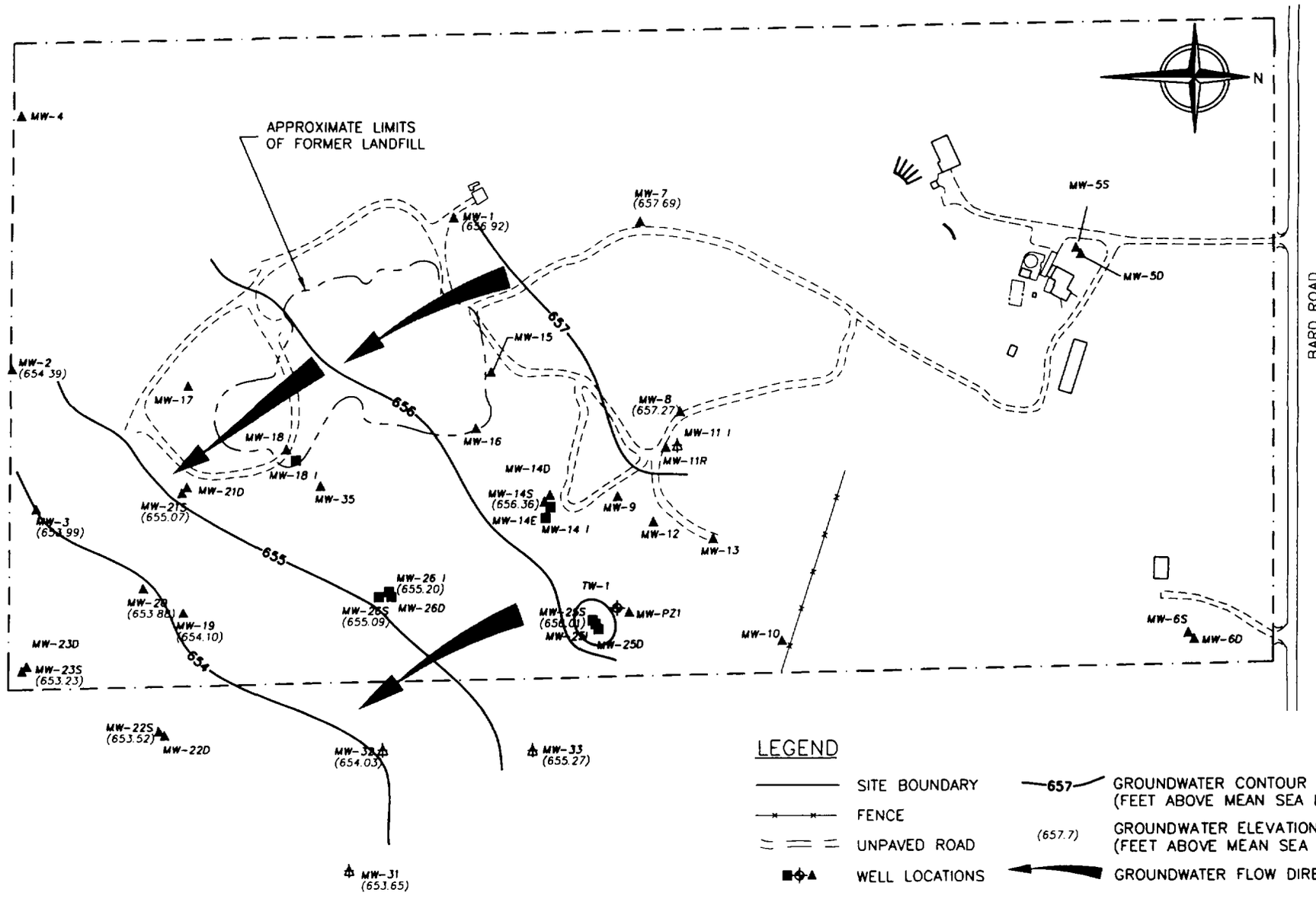
Shaw™
Shaw Environmental, Inc.

| | |
|---|---|
| DATE | 10/16/01 |
| DWN | ACE |
| APP | GRS |
| REV | DGS |
| PROJECT NO. | 806717 |

**FIGURE 2**
DUELL AND GARDNER LANDFILL
DALTON TOWNSHIP, MICHIGAN

**SITE MAP**

IMAGE Files: US Army Corp logo.bmp
XREF Files: <No Xrefs>
N:\CADDATA\DWG\Duell-Gardner\806717\LVDGSM02.dwg Thu, 07/Mar/02 02:06pm dstehle
Softdesk Project: N:\SDSK\PROJ\<none>




APPROXIMATE SCALE IN FEET

0 150 300 450

TAKEN FROM: EARTHTECH PDI REPORT, 11/96

Shaw™
Shaw Environmental, Inc.

| | |
|---|---|
| DATE | 09/30/02 |
| DWN | ET |
| APP | GRS/CL |
| REV | NAM |
| PROJECT NO. | 806717 |

**FIGURE 3**
DUELL AND GARDNER LANDFILL
DALTON TOWNSHIP, MICHIGAN

**SEPTEMBER 30, 2002**
**GROUNDWATER GRADIENT MAP**

XREF Files:
IMAGE Files:
File: N:\CADDATA\DWG\Duell-Gardner\806717\LVDGWGM3.dwg Layout: Geoprobe_9-30-02 User: NMcPherson Nov 22, 2002 - 12:20pm

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